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AUTOMATIC BACKUP OF WIRELESS MOBILE DEVICE DATA ONTO GATEWAY SERVER WHILE DEVICE IS IDLE

BACKGROUND OF THE INVENTION

1. Technical Field:

5   The present invention relates generally to computer software and, more particularly, to providing data backup for battery operated wireless devices over a network.

2. Description of Related Art:

The use of computers has become more and more
10   pervasive in society. This pervasiveness includes the integration of personal computer technology into phones. By utilizing computer technology, users or callers have access to computing functions and resources in a personal, portable device. In addition, it is envisioned
15   that phone users would be able to use some of the same software elements in a phone that are used at home or in the office. Various applications have been developed and are being developed for use in phones. These applications generally include communication applications
20   to help a user stay in touch with other persons at home or in the office, such as voice mail, e-mail, or two-way paging with short text messages. Some phones incorporate so-called personal information manager (PIM) technology, such as an address book, phone lists, or a calendar for
25   scheduling personal events.

Another adopted computer technology for use on a phone is voice and speech recognition. Voice recognition technology is already well developed in multimedia desktop personal computers and, when incorporated into a
30   phone, allows a phone user to easily control and interact

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with a telephone application, such as automatically
dialing a phone number, while obviating the need for
manual input. Phones are becoming so ubiquitous that
many people carry their phones so that they have some
5   means for being in constant communication contact with
others. Examples of common use of portable phones
include carrying and using a phone within an automobile
or possibly carrying the phone while shopping in a mall.

However, wireless phones as well as other wireless
10   devices, such as personal digital assistants, are battery
operated devices. Thus, the information stored on the
devices are available only so long as the battery does
not fail or become completely discharged. This presents
the potential that data that may be very valuable to the
15   user may be lost without any mechanism for recovery.
Therefore, it would be advantageous to have a mechanism
to automatically backup data from wireless devices onto a
more stable platform such that the data may be retrieved
if lost from the wireless device.

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SUMMARY OF THE INVENTION

The present invention provides a method, system, and computer program product for backing up data from a wireless device onto a server via a network. In one embodiment, a backup server, responsive to a determination that data from a wireless device should be backed up, initiates a backup process. The backup process may be initiated, for example, by pushing a request to the wireless client via a proxy/gateway server requesting that the client transmit data to be backed up to the backup server. A determination as to when to backup may be made, for example, in response to an indication that the wireless device has been powered on or in response to a determination that a predetermined amount of time has elapsed since the last backup was performed. The backup server then receives the data from the wireless device and stores the data on a storage device connected to the network for later retrieval such that if the wireless device loses its data, the data can be retrieved from the backup server and reloaded onto the wireless device. The backed up data may be, for example, phone lists, calendars, address lists, or notes.

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BRIEF DESCRIPTION OF THE DRAWINGS

The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself, however, as well as a preferred mode of use, further objectives and advantages thereof, will best be understood by reference to the following detailed description of an illustrative embodiment when read in conjunction with the accompanying drawings, wherein:

Figure 1 depicts a system diagram illustrating a plurality of interconnected heterogeneous networks in which the present invention may be implemented;

Figure 2 depicts a block diagram of a data processing system that may be implemented as a server in accordance with a preferred embodiment of the present invention;

Figure 3 depicts a diagram of a client in the form of a wireless telephone in accordance with a preferred embodiment of the present invention;

Figure 4 depicts a block diagram of a wireless telephone in accordance with a preferred embodiment of the present invention;

Figure 5 depicts a diagram illustrating data flow between the data backup server and the wireless device in accordance with the present invention;

Figure 6 depicts a pictorial diagram illustrating data flow for a client retrieving backed up data in accordance with the present invention;

Figure 7 depicts a process flow and program function for backing up data from a wireless device onto a server in accordance with the present invention; and

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Figure 8 depicts a process flow and program function for reloading backed up data onto a client in accordance with the present invention.

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DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference now to the figures, and in particular
with reference to **Figure 1,** a system diagram illustrating
a plurality of interconnected heterogeneous networks in
5   which the present invention may be implemented is
depicted. As illustrated, an Internet Protocol (IP)
network **102,** a Local Area Network (LAN) / Wide Area
Network (WAN) **104,** the Public Switched Telephone Network
(PSTN) **109,** a cellular wireless network **112,** and a
10   satellite communication network **116** make up the plurality
of heterogeneous networks serviced by the personal
mobility system of the present invention.

IP network **102** may be the publicly available IP
network, a private IP network, or a combination of public
15   and private IP networks. In any case, IP network **102**
operates according to the Internet Protocol and routes
packets among its many switches and through its many
transmission paths. IP networks are generally known in
the art to be expandable, fairly easy to use and heavily
20   supported. Coupled to IP network **102** is a Domain Name
Server (DNS) **108** to which queries may be sent, such
queries each requesting an IP address based upon a
Uniform Resource Locator (URL). IP network **102** supports
32 bit IP addresses as well as 128 bit IP addresses,
25   which are currently in the planning stage.

LAN/WAN **104** couples to IP network **102** via a proxy
server **106** (or another connection). LAN/WAN **104** may
operate according to various communication protocols,
such as the Internet Protocol, the Asynchronous Transfer
30   Mode (ATM) protocol, or other known packet switched
protocols. Proxy server **106** serves to route data between

IP network **102** and LAN/WAN **104**. A firewall that precludes unwanted communications from entering LAN/WAN **104** may also be located at the location of proxy server **106**.

5   Computer **120** couples to LAN/WAN **104** and supports communications with LAN/WAN **104**. Computer **120** may employ the LAN/WAN and proxy server **106** to communicate with other devices across IP network **102**. Such communications are generally known in the art and will not be further

10   described herein except to expand upon the teachings of the present invention. As is also shown, phone **122** couples to computer **120** and may be employed to initiate IP Telephony communications with another phone or voice terminal using IP Telephony. In such an IP telephony

15   system, a gatekeeper **152** is deployed by a service provider to manage IP telephony for its users. An IP phone **154** connected to IP network **102** (or other phone, e.g., phone **124)** may communicate with phone **122** using IP telephony.

20   PSTN **109** is a circuit switched network that is primarily employed for voice communications, such as those enabled by a standard phone **124**. However, PSTN **109** also supports the transmission of data. Data transmissions may be supported to a tone based terminal,

25   such as a FAX machine **125,** to a tone based modem contained in computer **126,** or to another device that couples to PSTN **109** via a digital connection, such as an Integrated Services Digital Network (ISDN) line, an Asynchronous Digital Subscriber Line (ADSL), or another

30   digital connection to a terminal that supports such a connection. As illustrated, a voice terminal, such as phone **128,** may couple to PSTN **109** via computer **126** rather

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than being supported directly by PSTN **109**, as is the case with phone **124**. Thus, computer **126** may support IP telephony with voice terminal **128**, for example.

 5   Cellular network **112** supports wireless communications with terminals operating in its service area (which may cover a city, county, state, country, etc.). As is known, cellular network **112** includes a plurality of towers, e.g., **130**, that each service communications within a respective cell. Wireless

10   terminals that may operate in conjunction with cellular network **112** include wireless handsets **132** and wirelessly enabled laptop computers **134**, for example. Wireless handsets **132** could be, for example, personal digital assistants, wireless or cellular telephones, or two-way

15   pagers. Cellular network **112** couples to IP network **102** via gateway **114**.

       Wireless handsets **132** and wirelessly enabled laptop computers **134** may communicate with cellular network **112** using a wireless application protocol (WAP). WAP is an

20   open, global specification that allows mobile users with wireless devices, such as, for example, mobile phones, pagers, two-way radios, smartphones, communicators, personal digital assistants, and portable laptop computers, to easily access and interact with information

25   and services almost instantly. WAP is a communications protocol and application environment and can be built on any operating system including, for example, Palm OS, EPOC, Windows CE, FLEXOS, OS/9, and JavaOS. WAP provides interoperability even between different device families.

30   WAP is the wireless equivalent of Hypertext Transfer Protocol (HTTP) and Hypertext Markup Language (HTML). The HTTP-like component defines the communication

protocol between the handheld device and a server or
gateway.   This component addresses characteristics that
are unique to wireless devices, such as data rate and
round-trip response time.   The HTML-like component,

5   Wireless Markup Language (WML), defines new markup and
scripting languages for displaying information to and
interacting with the user.   This component is highly
focused on the limited display size and limited input
devices available on small, handheld devices.   For

10   example, a typical cell phone may have only a
4x10-character display with 16-gray levels and only a
numeric keypad plus up/down volume keys.

Cellular network **112** operates according to an
operating standard, which may be the Advanced Mobile

15   Phone System (AMPS) standard, the Code Division Multiple
Access (CDMA) standard, the Time Division Multiple Access
(TDMA) standard, or the Global System for Mobile
Communications or Groupe Speciale Mobile (GSM), for
example.   Independent of the standard(s) supported by

20   cellular network **112**, cellular network **112** supports voice
and data communications with terminal units, e.g., **132**
and **134**.

Satellite network **116** includes at least one
satellite dish **136** that operates in conjunction with a

25   satellite **138** to provide satellite communications with a
plurality of terminals, e.g., laptop computer **142** and
satellite handset **140**.   Satellite handset **140** could also
be a two-way pager.   Satellite network **116** may be
serviced by one or more geosynchronous orbiting

30   satellites, a plurality of medium earth orbit satellites,
or a plurality of low earth orbit satellites.   In any
case, satellite network **116** services voice and data

communications and couples to IP network **102** via gateway **118**.

Wireless Proxy **160** is coupled to IP network **102** and is coupled to a plurality of towers, e.g., **162**, which

5   each provide wireless communications with wireless devices such as wireless device **164**.   Wireless Proxy **160** provides access to IP network **102** to wireless device **164**, such as a personal digital assistants (PDA) or a wireless telephone, that may require proprietary or other special

10   protocols in order to communicate with IP network **102**. For example, wireless proxy server **160** may be a 3Com server utilizing 3Com protocols for communicating with a Palm VII, a handheld portable computing device available from 3Com Corporation in Santa Clara, California.

15   In a preferred embodiment of the present invention, wireless proxy **160** is a 3Com proxy server supporting communications with Palm VII personal organizer and portable computing device **164** is a Palm VII personal organizer.   In this embodiment, communications between

20   wireless proxy server **160** and portable computing device **164** is facilitated by the use of Palm Query Applications (PQAs).   A PQA is like a mini-Web site that resides on portable computing device **164**.   That is, a PQA is a special kind of record database.   A typical PQA contains

25   an HTML form or a list of hyperlinks that request additional information either locally — on personal computing device **164** — or remotely — on the Internet.

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Much of the content on the Internet is designed to take advantage of the power of Pentium/RISC-class computers with large, high resolution color monitors and fast and cheap Internet access. In these circumstances,

5 there is little reason to economize on the abundant connect time and large file size that make Web browsing such a rich, multimedia experience from a desktop or notebook computer.

However, this model is not the best model for a

10 small, low-power computer like the Palm VII organizer with its tiny screen, battery powered operation, and relatively slow and expensive wireless connection to the Internet. Rather than duplicate the Web browsing model on a handheld computer, PQAs are developed that access

15 targeted bits of Internet information — like clippings from a newspaper. Typically, a handheld computer user does not focus on following hyperlinks to the Internet (although this is available), but instead, they compose a simple query in the PQA (for example a request for a

20 stock quote) and then send that query over the air.

Also included in network **100** is Data Backup Server **170**. Data Backup Server **170** is connected to IP network **102** and provides data backup for battery operated wireless devices, such as, for example, wireless

25 telephones or PDAs, connected over IP network **102**. However, it should be noted that the present invention may also be implemented within a non-IP based network. At predetermined intervals or when notified that a user has powered on a wireless device, the data backup server

30 **170** pushes a command to the wireless device instructing the wireless device, such as wireless device **140, 164** or **132**, to upload data, such as, for example, calendars,

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address lists, phone books, notepad data, appointments,
or key configuration information, for backup on backup
data server **170**. The backup data server **170** stores the
information along with an indication of ownership and

5   then may provide the data to the owner when requested.
The owner may request to download saved data, for
example, after losing the information due to a battery
failure. All of this is performed without notification
of or action on the part of the user and may be performed

10   during times when the wireless device is idle or using
unused extra bandwidth during times when the wireless
device is in use. Thus, the present invention provides
cell phone and other wireless device users a painless and
effortless mechanism for protecting valuable information

15   and does not require user intervention.

Figure 1 is intended as an example and not as an
architectural limitation for the processes of the present
invention.

Referring to **Figure 2**, a block diagram of a data

20   processing system that may be implemented as a server,
such as, for example, Data Backup Server **170** or any of the
other servers in **Figure 1**, is depicted in accordance with
a preferred embodiment of the present invention. Data
processing system **200** may be a symmetric multiprocessor

25   (SMP) system including a plurality of processors **202** and
204 connected to system bus **206**. Alternatively, a single
processor system may be employed. Also connected to
system bus **206** is memory controller/cache **208**, which
provides an interface to local memory **209**. I/O bus bridge

30   **210** is connected to system bus **206** and provides an
interface to I/O bus **212**. Memory controller/cache **208** and
I/O bus bridge **210** may be integrated as depicted.

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Peripheral component interconnect (PCI) bus bridge
214 connected to I/O bus **212** provides an interface to PCI
local bus **216.** A number of modems may be connected to PCI
bus **216.** Typical PCI bus implementations will support

5 four PCI expansion slots or add-in connectors.
Communications links to network computers **108-112** in
Figure 1 may be provided through modem **218** and network
adapter **220** connected to PCI local bus **216** through add-in
boards.

10 Additional PCI bus bridges **222** and **224** provide
interfaces for additional PCI buses **226** and **228,** from
which additional modems or network adapters may be
supported. In this manner, data processing system **200**
allows connections to multiple network computers. A

15 memory-mapped graphics adapter **230** and hard disk **232** may
also be connected to I/O bus **212** as depicted, either
directly or indirectly.

Those of ordinary skill in the art will appreciate
that the hardware depicted in **Figure 2** may vary. For

20 example, other peripheral devices, such as optical disk
drives and the like, also may be used in addition to or in
place of the hardware depicted. The depicted example is
not meant to imply architectural limitations with respect
to the present invention.

25 The data processing system depicted in **Figure 2** may
be, for example, an IBM RISC/System 6000 system, a product
of International Business Machines Corporation in Armonk,
New York, running the Advanced Interactive Executive (AIX)
operating system.

30 With reference now to **Figure 3,** a diagram of a
client in the form of a wireless telephone is depicted in
accordance with a preferred embodiment of the present

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invention. Wireless telephone **300** includes a display **302**
for presenting textual and graphical information.
Display **302** may be a known display device, such as a
liquid crystal display (LCD) device. The display may be
5   used to present a map or directions, calendar
information, a telephone directory, an electronic mail
message, or the telephone number of a dialed party.

Wireless telephone **300** may also include keypad **304**,
speaker **306**, antenna **308**, and microphone **312**. Keypad **304**
10   may be used to receive user. Speaker **306** provides a
mechanism for audio output, such as the voice audio of a
party to whom the user of wireless telephone **300** may be
speaking. Microphone **312** provides a mechanism for audio
input such as for speaking to a called party. Antenna
15   **308** provides a mechanism used in establishing a wireless
communications link between wireless phone **300** and a
network, such as network **102** in **Figure 1.**

Turning now to **Figure 4,** a block diagram of a
wireless telephone is shown in accordance with a
20   preferred embodiment of the present invention. Wireless
telephone **400** is an example of a wireless telephone, such
as wireless telephone **300** in **Figure 3,** in which code or
instructions implementing the processes of the present
invention may be located. Wireless telephone **400** includes
25   a bus **402** to which processor **404** and main memory **406** are
connected. Display adapter **408**, keypad adapter **410**,
storage **412**, microphone adapter **418**, and audio adapter **414**
also are connected to bus **402**. Cradle link **416** provides a
mechanism to connect wireless telephone **400** to a cradle
30   used in synchronizing data in wireless telephone **400** with
another data processing system.

An operating system runs on processor **404** and is used
to coordinate and provide control of various components
within wireless telephone **400** in **Figure 4**. Instructions
for the operating system and applications or programs are
5   located on storage devices, such as storage **412**, and may
be loaded into main memory **406** for execution by processor
404.

Those of ordinary skill in the art will appreciate
that the hardware in **Figure 4** may vary depending on the
10 implementation. Other internal hardware or peripheral
devices, such as flash ROM (or equivalent nonvolatile
memory) or optical disk drives and the like, may be used
in addition to or in place of the hardware depicted in
Figure 4.

15 With reference now to **Figure 5**, a diagram
illustrating data flow between the data backup server and
the wireless device is depicted in accordance with the
present invention. In one embodiment, a data backup
server **502** instructs **B1** the proxy/gateway **504** to push a
20 service loading content type (SL) **B2** to the wireless
client **506** requesting that the client **506** send its data
to the data backup server **502** using, for example, the
Push Access Protocol (PAP). More information about SL
may be found in the "Wireless Application Protocol
25 Service Loading Specification" which may be found on the
Internet at
http://www1.wapforum.org/tech/documents/WAP-168-ServiceLo
ad-19991108-a.pdf and is hereby incorporated by reference
for all purposes. Typically, the SL command transferred
30 in step **B1** is textual and uses the HTTP protocol. The
time at which the data backup server **502** initiates a
backup operation may be set at predetermined intervals or

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maybe performed any time the data backup server **502**
receives notification that client **506** has been powered
on. Thus, in whatever implementation is chosen, the data
from client **506** is backed up to data backup server **502**

5   periodically or occasionally such that updates to data on
client **506** may be backed up routinely. The data that is
backed up may be, for example, a phone number list, an
address list, a calendar, appointment schedules, notepad
data, key configuration data, or any of a number of other

10   types of data that may be stored on client **506**.

Once proxy/gateway **504** receives the textual SL, the
proxy/gateway **504** translates the textual SL into a binary
SL suitable for the wireless client **506**. Wireless client
506 may be, for example, a wireless telephone such as

15   wireless phone **400** in **Figure 4** or maybe a personal
digital assistant (PDA). The data backup server **502**
provides the SL with the Uniform Resource Identifier
(URI) to the Wireless Markup Language (WML) deck (i.e.
application) that should be executed in client **506** in

20   order to send the requested data to the data backup
server **502**. The proxy/gateway **504** sends the SL **B2** to
client **506** using, for example, the Push Over-the-Air
(Push OTA) Protocol. The Push OTA Protocol is a standard
protocol for conveying content between a push

25   proxy/gateway and a client.

The client **506** receives the push **B2** containing the
SL, but, typically, the user of client **506** is not made
aware of this. Client **506** waits for a period in which it
is idle (i.e. the user is not using the client for other

30   services) and then sends a request **B3** to the
proxy/gateway **504** to retrieve (pull) the application
identified by the SL that will transfer the data from

client **506** to the data backup server **502**. The request **B3**
is typically made using a Wireless Session Protocol (WSP)
Get command. The proxy/gateway **504** converts the WSP Get
into an HTTP Get and sends **B4** the request to the data

5   backup server **502** or to some other server where the URI
is located. The data backup server **502** then sends **B5** the
WML application in a textual format to proxy/gateway **504**
where it is translated into a binary WML format and sent
B6 to client **506**.

10   Once client **506** receives the WML binary application,
client **506** executes the WML binary application which
transfers **B7** the requested data from client **506** to
proxy/gateway **504** using, for example, the Wireless
Application Protocol (WAP). Proxy/gateway **504** translates

15   the WAP data received from client **506** into an HTTP format
and sends **B8** the data to data backup server **502**. Data
backup server **502**, upon receiving the data, stores the
data, either on server **502** or in some remote storage
location, with an indication of the client **506** to which

20   the data belongs. Thus, if client **506** later loses the
data, for example, because of battery failure, then
client **506** may retrieve the data from data backup server
502 and reload the data.

        A SL command is pushed to client **506** rather than the

25   actual application that will transfer data from client
506 to data backup server **502** because is not always
suitable to push content that is executed or rendered
directly upon reception to a mobile device, such as
client **506,** especially if the client is busy with other

30   activities such as executing another service. This is
due to the fact that memory and/or processing constraints

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found in many mobile devices are such that neither storing nor processing content in such a situation is feasible. However, for devices where such constraints do not exist, it is possible, in other embodiments of the present invention, to push the application directly to the client, thus eliminating four data transfer steps.

In such an embodiment, the data backup server **502** would send the application to the proxy/gateway **504** for conversion into a protocol suitable for client **506**. Proxy/gateway **504** then sends the application to client **506** which executes the application, thus retrieving and sending the requested data from client **506** to proxy/gateway **504**. Proxy/gateway **504** receives the data from client **506** and translates the data into a protocol suitable for data backup server **502** and forwards the translated data to data backup server **502**.

In yet another embodiment, it is possible, if the client **506** has sufficient memory, that the application necessary to retrieve and transmit the requested data is stored on client **506**. In such case, data backup server **502** simply sends the request for data to client **506** via proxy/gateway **504**. Client **506** then retrieves the requested data and sends the data back to data backup server **502** via proxy/gateway **504**.

It is also possible in another embodiment, that the processes of the data backup server are incorporated into the proxy/gateway **504**, thus eliminating a number of data transfer steps. However, such an embodiment would be uncommon given the current state of implementation of wireless networks.

Although depicted with reference to data backup server **502** initiating a backup process, in other

embodiments, the client **506** may initiate the backup process.

Figure 5 is intended as an example and not as an architectural limitation for the processes of the present

5   invention.

With reference now to **Figure 6,** a pictorial diagram illustrating data flow for a client retrieving backed up data is depicted in accordance with the present invention. Whenever client **506** needs to retrieve backed

10   up data, for example, because the battery has died in client **506** thus causing the loss of data, client **506** sends a request **R1** to proxy/gateway **504** for the backed up data using, for example, a WAP protocol. Proxy/gateway **504** then translates the request into a format, such as

15   HTTP, suitable for data backup server **502** and sends **R2** the translated request to data backup server **502**. Data backup·server **502** retrieves the backed up data corresponding to the client **506** and sends **R3** the requested data to proxy/gateway **504**. Proxy/gateway **504**

20   translates the data into a format suitable for client **506** and sends **504** the translated requested data to client **506** which can then store the data. Thus, even though client **506** may momentarily lose valuable data, it is not lost for good since the data is backed up on data backup

25   server **502** and is retrievable.

With reference now to **Figure 7,** a process flow and program function for backing up data from a wireless device onto a server is depicted in accordance with the present invention. The process depicted may be

30   implemented on, for example, data backup server **502** in **Figure 5.** To begin, the data backup server determines that it is time to backup data from a client (step **702**).

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This determination may be made based, for example, on the expiration on a predetermined amount of time from the last data backup or on the determination that the client has been powered on. Once the determination to perform a
5   backup has been made, the data backup server pushes a data backup request to the client to transfer selected data to the data backup server (step **704**). This request may involve sending a SL to the client and have the client retrieve an appropriate application to perform the
10 backup or may merely be a request that the client can execute without retrieving any other application or data. The data backup server then receives the data from the client (step **706**) and stores the data on the data backup server or on some remote storage device for later
15 retrieval by the client if necessary (step **708**).

With reference now to **Figure 8**, a process flow and program function for reloading backed up data onto a client is depicted in accordance with the present invention. This reloading process may be implemented,
20 for example, on client **506** in **Figure 6.** The client sends a request to retrieve backed up data to the data backup server (step **802**). The client then receives the data from the backup data server (step **804**) and stores the retrieved data (step **806**), thus refreshing or reloading
25 data that may have been previously lost.

It is important to note that while the present invention has been described in the context of a fully functioning data processing system, those of ordinary skill in the art will appreciate that the processes of
30 the present invention are capable of being distributed in the form of a computer readable medium of instructions and a variety of forms and that the present invention

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applies equally regardless of the particular type of
signal bearing media actually used to carry out the
distribution. Examples of computer readable media
include recordable-type media such a floppy disc, a hard
5   disk drive, a RAM, and CD-ROMs and transmission-type
media such as digital and analog communications links.

The description of the present invention has been
presented for purposes of illustration and description,
but is not intended to be exhaustive or limited to the
10 invention in the form disclosed. Many modifications and
variations will be apparent to those of ordinary skill in
the art. The embodiment was chosen and described in
order to best explain the principles of the invention,
the practical application, and to enable others of
15 ordinary skill in the art to understand the invention for
various embodiments with various modifications as are
suited to the particular use contemplated.